Dec. 2, 1999

Mr. Michael P. Kenny
Executive Officer
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812

Dear Mr. Kenny:

This letter contains my review of the California Air Resources Board document titled "Proposed California Phase 3 Reformulated Gasoline Regulations. I have consulted with and read the reviews of the two other scientific peer reviewers, Prof. Catherine Koshland and Dean Lawrence Caretto, attended the Nov. 15, 1999 workshop held by the ARB, and consulted with various ARB staff. I have also reviewed the "Air Quality Impact of the Use of Ethanol in California Reformulated Gasoline – Staff Report" (Nov. 18, 1999), which covers a similar topic. I have confined my remarks to non-economic effects of the proposed regulations, as I am not qualified to comment on the cost aspects presented in the report.

The ARB staff proposes changes in the current California Phase 2 Reformulated Fuel Regulations (CaRFG2). The changes include a prohibition on the use of MTBE in gasoline, revised specifications for Phase 3 gasoline to ensure additional air quality benefits, and changes in the Predictive Model. The objectives were to "provide flexibility to refiners to make or import CaRFG3 without MTBE, to preserve significant emissions benefits realized from the current CaRFG2 regulations, and to obtain additional emissions reductions where technically feasible and economically reasonable".

General Comments

The proposed regulations appear to meet the stated objectives. The rational for the proposed changes is clearly presented, and, where possible, data is presented to justify the choices. Where data does not exist or is too uncertain to provide guidance, reasonable choices are made. The proposal would provide some additional emissions reductions over those achieved with the CaRFG2 regulations. While the emissions gains can be quantified, not all of the decisions can be defended with such precision. These include the cost/benefit analysis and the desire to maintain a sufficient California fuel supply. An example of this is the provision that the changes be "economically reasonable". This is more of a policy or political question than a scientific one, and the criteria involved are different. Many of these decisions were made in consultation with affected parties, such as the automobile manufacturers and the producers of gasoline and ethanol, though workshops and other communications. This approach is warranted and appropriate.

Timetable

The timetable proposed for the removal of MTBE is based on several considerations, including the deadlines set by the Executive Order D–5–99 and Senate Bills 989 (Sher) and 529 (Bowen), and the lead time necessary to change fuel production and delivery. There are also several on-going studies related to this report, including the evaluation of the environmental impacts of ethanol in gasoline, and revisions to the vehicle inventory (EMFAC2000). There are also time constraints placed on the ARB to make decisions which will be implemented in the coming years. The timing of these related studies make if difficult to use all of the information being generated in the CaRFG3 regulation process. While better results could have been obtained by better coordinating the studies, the time constraints prevented this. While I do not think that the results from this study would change significantly if more time were allowed, care must be taken in balancing the need for a timely decision with the effort and time needed to produce sound scientific results. Any regulations adopted should have sufficient flexibility to allow for reasonable changes if new results and findings warrant them.

Prohibition of MTBE

Like many others, I support the ban on MTBE in gasoline, and agree that trace amounts should not be prohibited. I also agree with the conditional ban of other ethers and alcohols other than ethanol unless a multimedia evaluation is conducted on their impacts to public health and the environment. This approach should help avoid potential problems when a significant amount of a chemical is introduced into the environment. It is important for the ARB to remain aware of all forms of exposure and environmental effects.

Changes in Sulfur, Benzene, T50, T90, and Aromatic Limits

There are several changes proposed in the limits for several properties of the fuels. These include a lowering of the sulfur and benzene amounts, with an increase in the T50, T90, and aromatic hydrocarbons. The changes are designed to provide flexibility in producing gasoline while maintaining volume and air quality benefits. The lower benzene limit will directly lead to reduced exposure to this chemical, and lower sulfur will reduce hydrocarbons, NOx, and toxics. The increases in the limits of the other parameters such as aromatics may appear to be a step backwards, but these properties can be exploited only if a particular fuel composition is shown to not produce additional emissions. The limits are reasonable, as they allow refiners some flexibility in producing gasoline, while maintaining acceptable vehicle performance.

Proposed Updates to the Predictive Model

The ARB staff proposes to add a new technology group (Tech 5) that would include 1996 through 2005 automobiles. There appears to be sufficient data to justify the new group. While there are some problems with the statistical fitting of various parameters, the ARB is dealing with them in a reasonable fashion, especially in eliminating some data that lead to results at odds with engineering expectations. The weighting factors will also be updated using the new EMFAC2000 inventory.

An evaporative emissions model will be added to the Predictive Model to allow variations in the RVP, and allow refiners to offset exhaust hydrocarbon emissions with evaporative hydrocarbon emissions. If the RVP is allowed to vary, then the addition to the model is necessary. My concern with this is the testing needed to derive the model parameters, especially for non-exhaust emissions. When the ARB tested some vehicles in the study of the impacts of using ethanol in California reformulated gasoline, none of the vehicles were tested for evaporative or running loss emissions. The ARB staff is aware that ethanol-containing fuels can effect cannister performance and be more permeable in automotive fuel systems, and suggests that more research in these areas is needed. I agree with that assessment.

CO Credit

The ARB staff is proposing that CO be counted in the overall ozone formation process. This is an appropriate and important addition, as CO is a precursor to ozone. CO is treated here as other organic compounds, using the well-established and reviewed reactivity. The ARB is consistent in their approach to ozone forming compounds. As in the ethanol study, Whitten (1999) suggested a higher value for the reactivity of CO, and the ARB responded in detail. While the calculations presented by Whitten appear correct, it is difficult to justify using different models and scenarios for a single species. The value of examining issues such as these should not be underestimated, and the continued input from outside experts such as Whitten should be encouraged.

Driveability Index

I have some concern about adopting a driveability index (DI) as proposed. The index is a property that is a more subjective measure obtained from trained drivers. It does not have a direct connection to the emissions as the other regulated properties do. The Predictive Model should capture the effects of changing the parameters responsible for the DI. It is not clear how a fuel with a driveability index higher than the proposed limit would affect actual emissions from a fleet of vehicles. In Table II-8, there is a calculation of "worst-case" for the DI using the limits for T50 and T90, and fixing the RVP. It is not certain whether this fuel would actually be a complying fuel, as changing other properties might not be enough to offset the emissions produced from the worst-case fuel. Finally, the choice of a DI of 1225 is not justified, and it appears to be between the values promoted by the automobile manufacturers and the oil companies.

California Reformulated Gasoline Blendstock For Oxygen Blending (CARBOB) Provisions

There are many unresolved issues regarding the CARBOB provisions, such as fungibility, sampling and testing, and certification to the proposed standards. The staff is aware of these issues, but was unable to address many of them because of time and resource constraints. They state that they are committed to address these issues in the 2001/2001 fiscal year. This is an example where the time constraints have not permitted a thorough examination of some problems that may occur when ethanol-containing fuels are introduced in California. While these issues do not have a direct impact on expected emissions, the forthcoming studies need be

examined to ensure there are no significant negative impacts on the implementation of the regulations.

Variable RVP

The proposed regulations allow for varying RVP, and including the effect of different RVP values in the Predictive Model. This additional flexibility is fine, as increases in emissions due to increased RVP must be offset by decreases from other fuel parameters. However, the changes in the emissions with RVP need to be properly evaluated, especially the non-exhaust emissions. As noted above, since these emissions are becoming a larger fraction of the total vehicle emissions, it is important to know these emissions for fuels with varying ethanol levels.

Commingling

The effect of consumer commingling, where ethanol-containing and ethanol-free gasolines are mixed, produces a fuel with a higher Reid Vapor Pressure (RVP). The mixed fuel would increase non-exhaust emissions. Under current federal law, where most of the gasoline in California is required to have an oxygenate, it is likely that commingling would not be a significant problem, since all gasolines would probably contain ethanol. However, Governor Davis has requested a waiver (April 12, 1999) from the EPA, and the ARB has supported this request. If granted, commingling could be more common. Factors such as grade and brand loyalty, and geographical and regulatory boundaries need to be considered, especially for the scenario where the fuel supply is limited in quantity. The effect of a waiver on commingling should be researched in a timely fashion, and potential solutions should be examined.

Outside Suggestions/Comments

I encourage more comments from industries and other interested groups regarding the methods and assumptions made in this study. The questions, suggestions, and remarks made in these comments are often very valuable. The written comments are especially important, as they usually contain more information than presentations given at workshops and hearings. Given sufficient time, the ARB staff normally responds in detail to the comments. This process often clarifies the issues, allows correction of errors, and improves the reports.

Compliance Margins

One of the goals of the regulations is to preserve the emission benefits from CaRFG2. What is being preserved is the actual gains since the new regulations are based in part on compliance margins, the difference between what refiners report for a regulated property and an average of 64 samples measured by the ARB from refineries in 1998. It should be made clear that the emissions benefits are in excess of the CaRFG2 regulations, and that it is the desire of the ARB to maintain the excess reductions. Since this compliance margin is an important factor in setting the new regulations, more information on the gasolines sampled should be presented (e.g., how many refineries, what fraction of the total gasoline supply is represented, how large are the sampling errors and uncertainties?).

Other Models

High emitting vehicles, off-cycle, and off-road emissions can produce a significant fraction of vehicle emissions. The ARB (with others) attempted and failed to develop a reliable high emitter model. Both the ARB and the Auto/Oil Air Quality Improvement Research Program conclude that it is extremely difficult to test the effects of different fuels on these vehicles using current procedures. The effects of different fuels on off-cycle and off-road emissions were also investigated, with the conclusion that there is very little data available to quantify results.

While these conclusions are reasonable, the ARB should continue in their efforts to quantify these emissions. As "normal" exhaust emissions decrease with improved technology and fleet turnover, the relative importance of these other emission sources (plus non-exhaust emissions) increases.

Ethanol Cost

The cost of ethanol appears to include a federal tax credit. While this is stated in the text, the financial impact of this credit should be clarified. While the tax credit is not borne entirely by California taxpayers, it is still an additional cost that should be considered.

Summary

In summary, the proposed regulations as a whole are sound and well supported. The need to eliminate MTBE from the California gasoline supply is the major driving force for these changes. These regulations will do that, and preserve the significant gains in air quality from the reformulated fuels program. Unfortunately, there are also significant costs to Californians that will be incurred.

Sincerely,

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